What is claimed is:

[Claim 1] 1. A device for creating micrograd ients in solution comprising:

a microfluidic channel with openings at each end and two or more apertures in the channel walls;
electrodes placed in or near the openings at either end of the channel; and,
an electrical power supply connected to the electrodes.

[Claim 2] 2. A device as in Claim 1 wherein the power supply is connected to the electrodes such that several distinct current paths exist from one end of the channel to the other and current flows along all of these paths when an electric field is applied along the channel by the combination of the power supply and the electrodes.

[Claim 3] 3. A device as in Claim 1 wherein the power supply is connected to the electrodes such that simultaneous flow of fluid occurs through two or more of the apertures and a chemical concentration gradient is formed near the apertures.

[Claim 4] 4. A device as in Claim 1 wherein the length of the channel is between about ten microns and ten millimeters, the transverse dimension of the channel is between about 0.1 and one hundred microns, and the dimensions of the apertures are between about 0.1 and ten microns across.

[Claim 5] 5. A device as in Claim 1 further comprising structures that form indentations in the channel near the apertures, such indentations being approximately the size of a living cell.

[Claim 6] 6. A method of creating micrograd ients in solution comprising:

providing a microchannel having two or more apertures;
filling the microchannel with a solution;
providing a bath in contact with the apertures of the microchannel; and,
applying an electric field along the microchannel.

[Claim 7] 7. A method for positioning or sorting cells comprising:

providing a microchannel having two or more apertures to a bath;
applying an electric field along the microchannel;
introducing cells in solution into the microchannel; and,
moving the solution and the cells by electroosmotic flow until electric current flow along the channel drops essentially to zero.

[Claim 8] 8. A method of delivering reagents to cells comprising:

providing a microchannel having two or more apertures to a bath;
applying an electric field along the microchannel;
introducing reagents into the microchannel; and,
positioning cells in the bath near the apertures.

[Claim 9] 9. A microfluidic device comprising:

a microfluidic channel defining a flow path for a fluid having a known concentration of a selected chemical, the microfluidic channel comprising an inlet, an outlet, and a plurality of apertures defined in the channel for providing fluid communication between the channel and a reservoir containing a sample solution;
electric field means provided for inducing electroosmotic flow along the flow path; and,
means for applying pressure to the fluid in the flow path such that fluid flows simultaneously out of the channel at the apertures and forms a concentration gradient at the apertures along the channel such that cells cultured near each aperture are exposed to a separate concentration of the chemical corresponding to the location of the aperture along the concentration gradient.